PARASITES OF NATIVE AND EXOTIC FRESHWATER FISHES IN THE SOUTH-WEST OF WESTERN AUSTRALIA

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DECLARATION

I declare that this thesis is my own account of my research and contains as its main content work which has not previously been submitted for a degree at any tertiary education institution.

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Abstract

Fewer than 200 fish species are found in freshwater habitats in Australia, of which 144 are confined exclusively to freshwater. At least 22 species of exotic freshwater fish have been introduced into Australia, and 19 of these have established self-sustaining populations. However, the parasite fauna of both native and exotic freshwater fishes in Australia is poorly known. This is particularly the case in the south-west of Western Australia, where there have been no previous comprehensive studies of the parasites of 14 native species and nine or more exotic species of fish found in freshwater habitats.

This study represents a survey of the parasites of freshwater fishes in the South West Coast Drainage Division and reports 44 putative species of parasites in 1429 individual fishes of 18 different species (12 native and six exotic) from 29 locations. Parasites were found in 327 (22.88%) fishes, and of the infected fishes, 200 (61.16%) were infected with only one species of parasite and 127 (38.84%) were infected with two or more species of parasites. For helminth and arthropod parasites, which were more comprehensively surveyed than protozoan and myxozoans, I found 37 species compared to 77 species found in a recent study of fishes from the East Coast Drainage Division.

The present study demonstrated that parasitic infection was significantly more common in native fish species (mean prevalence of infection with any species of parasite = 0.36 ± 0.09) than in exotic fish species (0.01 ± 0.12). Parasites were found in all native fish species, but in only two exotic fish species that were examined.

Parasite regional and component community diversity were estimated by species richness (the number of species, S) and by an index of taxonomic diversity (H_T). Both parasite species richness and parasite taxonomic diversity were significantly greater in native fish species (mean S = 10.5 ± 2.3 SE; mean H_T = 1.19 ± 0.14 SE) than in exotic fish species (mean S = 1.6 ± 3.3 SE; mean H_T = 0.27 ± 0.20 SE). These relationships were consistent over all geographic locations that were sampled. The reduced parasite load of exotic species compared to native species has been previous reported across a wide range of taxa. It is thought to arise partly because founding populations of hosts have a low probability of harbouring the species' total parasite fauna, and partly because parasites that infect introduced exotic species may not be able to maintain their life cycle in the new environment. It has been suggested that a reduced parasite load increases the competitive ability of exotic species compared to native species (the parasite release hypothesis) and this may partly explain the abundance and apparent competitive success of exotic over native species of freshwater fish in the South West Coast Drainage Division.

For native species of fish, there were major differences among species in both prevalence of parasitic infection and parasite community diversity, but this variation was not related to fish size, whether the fish were primarily freshwater or primarily estuarine, or whether they were primarily demersal or pelagic.

In this study, I report two new parasites in south western Australian waters. Both are copepod parasites; *Lernaea cyprinacea* and a new species of *Dermoergasilus*. The *Dermoergasilus* appears to be native to the south-west of Western Australia and has been described as *Dermoergasilus westernensis*. It differs from previously described

species in the genus principally by the armature of the legs. This new species was found on the gills of freshwater cobbler, *Tandanus bostocki* and western minnow, *Galaxias occidentalis* in two different river systems.

Lernaea cyprinacea is an introduced parasitic copepod found on the skin and gills of freshwater fishes in many areas of the world. The parasite has not previously been reported in Western Australia. We found infestations of *L. cyprinacea* on four native fish species (*G. occidentalis*; *Edelia vittata*; *Bostockia porosa*; *T. bostocki*) and three introduced fish species (*Carassius auratus*; *Gambusia holbrooki*; *Phalloceros caudimaculatus*) at two localities in the Canning River, in the south-west of Western Australia. The parasite has the potential to have serious pathogenic effects on native fish species, although it appears to be currently localised to a small section of the Canning River.

Over all localities from which fishes were sampled in the present study, the proportion of native freshwater fishes with parasitic infections and the component community diversity of the parasite fauna of native fishes were both negatively related to habitat disturbance, in particular to a suite of factors (river regulation, loss of riparian vegetation, eutrophication and presence of exotic fish species) that indicate increased human usage of the river and surrounding environment. The reduced parasite load and diversity in native fishes from south-west rivers with greater human usage was due principally to the loss of a number of species of trematode, cestode and nematode endoparasites which use fishes as intermediate hosts. Other studies have also found that endoparasites with complex life cycles are most likely to be adversely affected by environmental changes, presumably because

any environmental changes which impact on either free-living parasite stages or on any of the hosts in the complex train of parasite transmission will reduce parasite population size and may cause local extinction of the parasite species.

The most heavily infected species of native freshwater fish in the South West Coast Drainage Division was *T. bostocki* with 96% of all individuals containing at least one species of parasite. As with most freshwater fishes of south-west Australia, *T. bostocki* is limited in its distribution to waterways with relatively low salinity. The degree of parasitism and histopathology of internal and external organs in *T. bostocki* from the Blackwood River was examined over a period of rapid, seasonal changes in water salinity. As salinity increased, the infracommunity richness and prevalence of ectoparasites on the skin of fishes decreased, while the infracommunity richness and prevalence of endoparasites increased. This was associated with a decrease in histopathological lesion scores in the skin and an increase in histopathological lesion scores in internal organs, particularly the intestine. I hypothesise that the seasonal spike in salinity had two contrasting effects on parasitic infections of *T. bostocki*. Firstly, it increased the mortality rate of parasites directly exposed to water, leading to a decrease in ectoparasitic infection and associated pathology. Secondly, it suppressed immune function in fish, leading to a decreased mortality rate of parasites not directly exposed to water and a more severe pathological response to endoparasitism.